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Nook et al.

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(54) **BATTERY ASSEMBLY DEVICE**

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H01M 50/543 (2021.01)
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CPC ***H02J 7/14*** (2013.01); ***H01M 50/553*** (2021.01); ***H01M 50/566*** (2021.01); ***H01R 11/24*** (2013.01); *H02J 1/122* (2020.01)

(58) **Field of Classification Search**
CPC H02J 7/342
See application file for complete search history.

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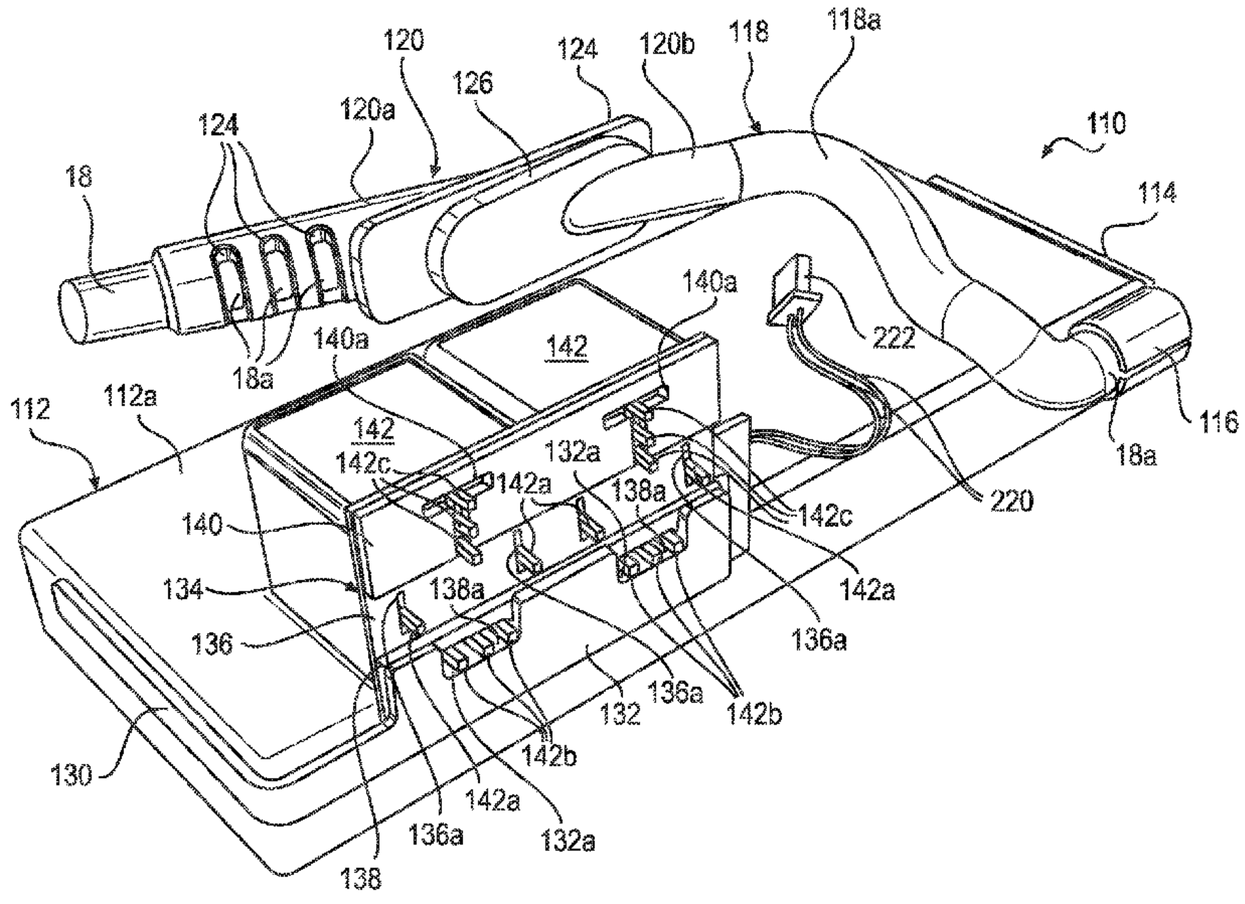
(57) **ABSTRACT**

A battery assembly device for a battery jump starting device. The battery assembly is configured to maximize electrical conductivity from a battery pack of the battery jump starting device to a battery to be recharged.

32 Claims, 11 Drawing Sheets



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H02J 1/10	(2006.01)
H01M 50/566	(2021.01)
H01M 50/553	(2021.01)

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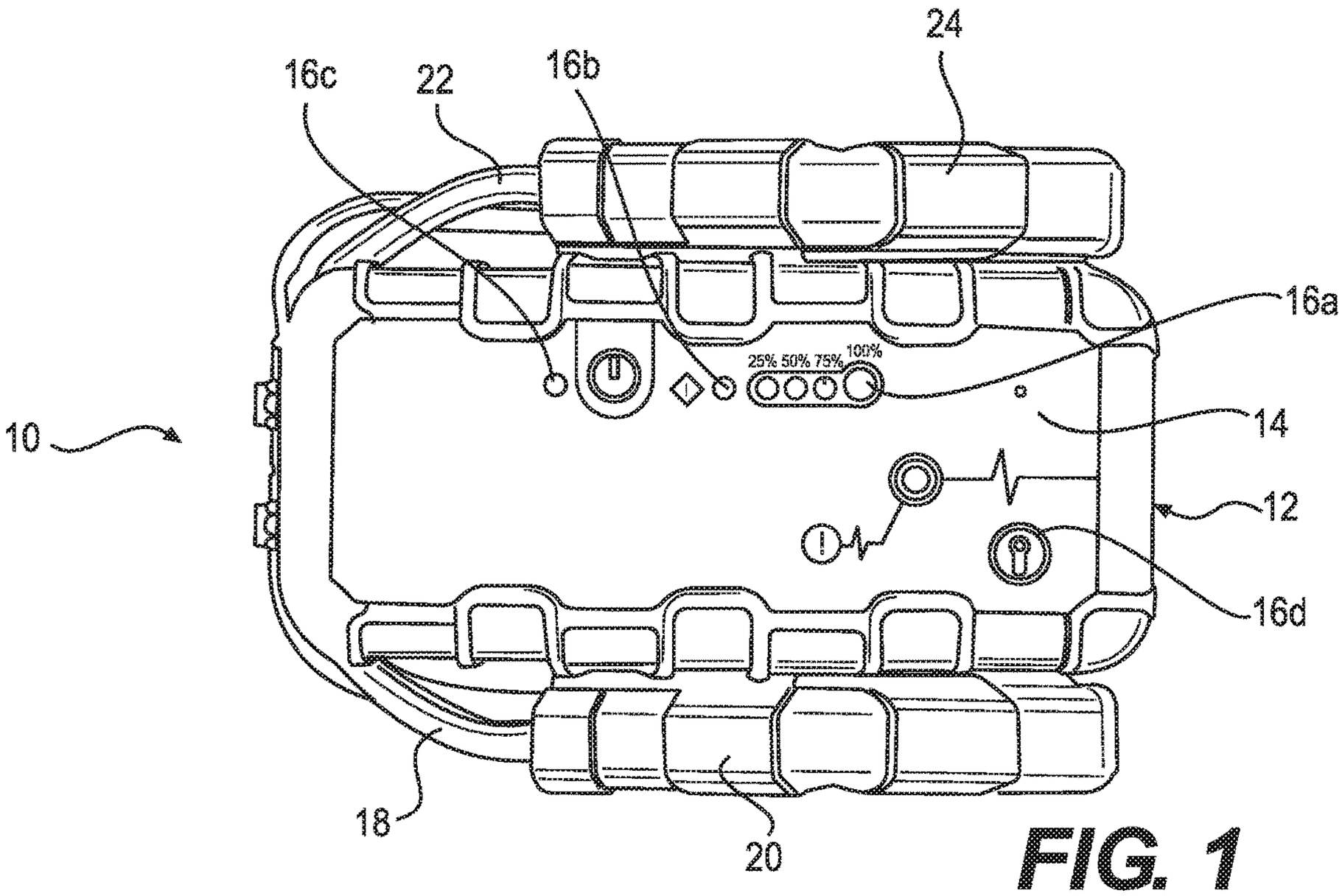


FIG. 1

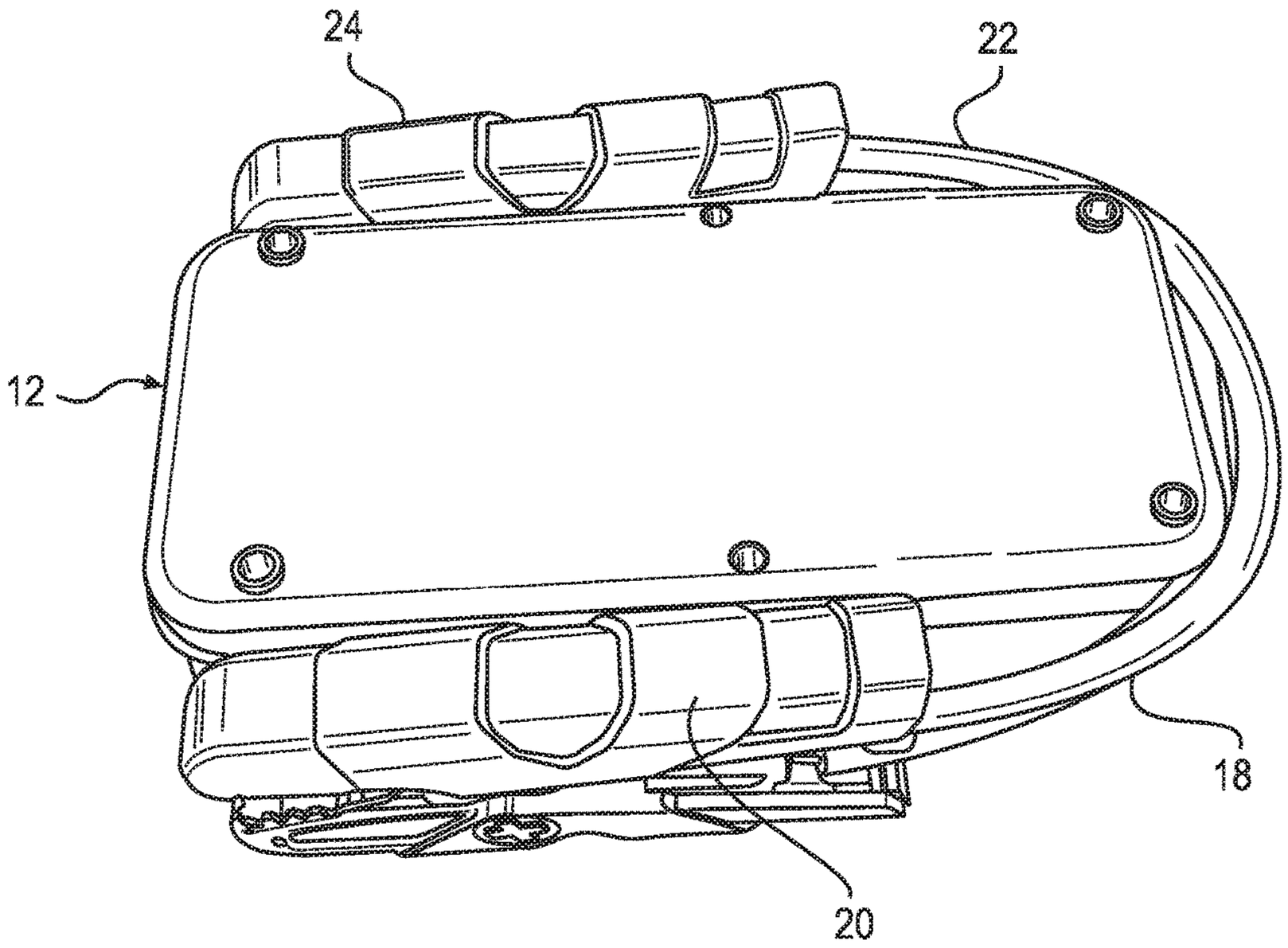


FIG. 2

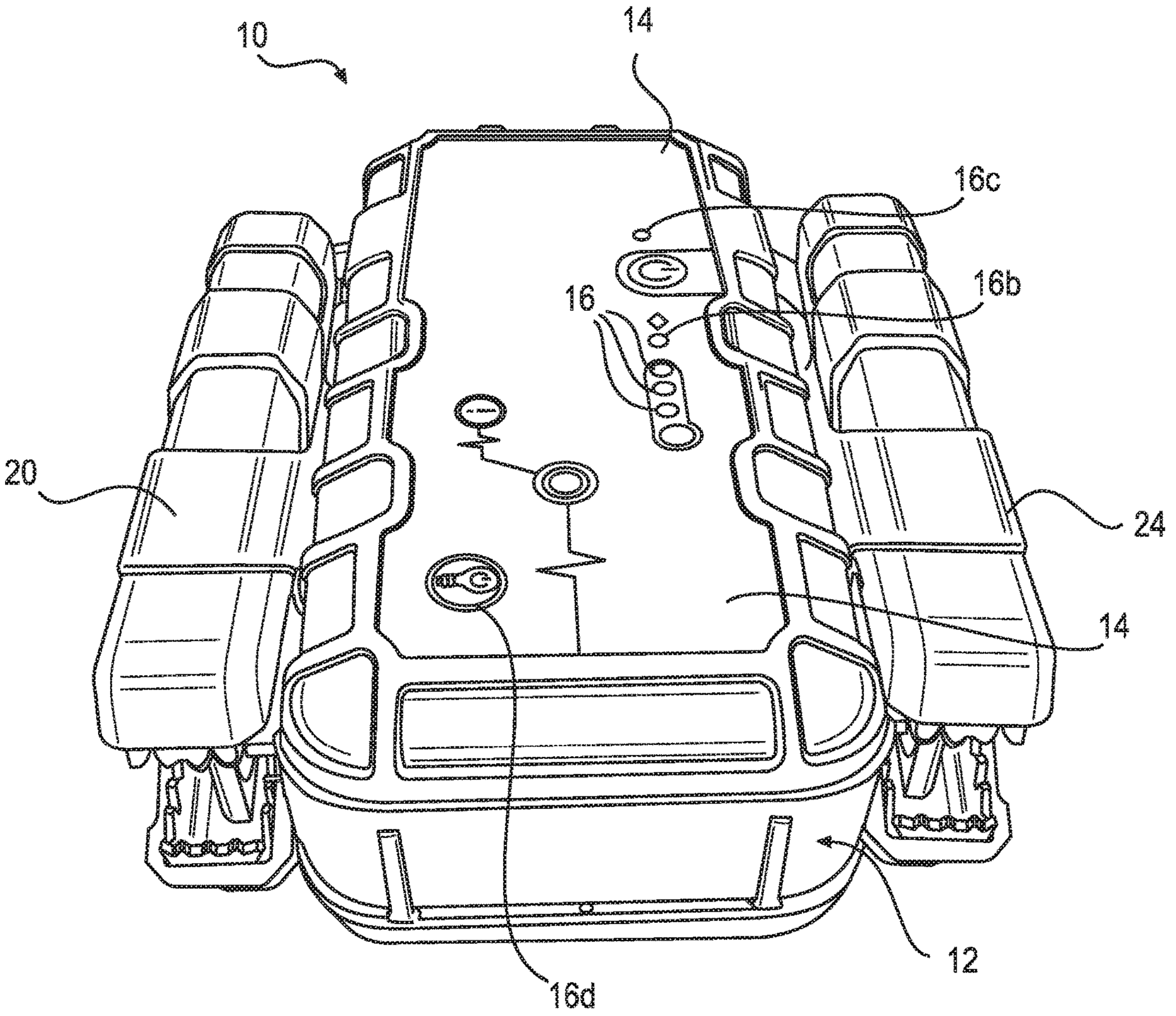


FIG. 3

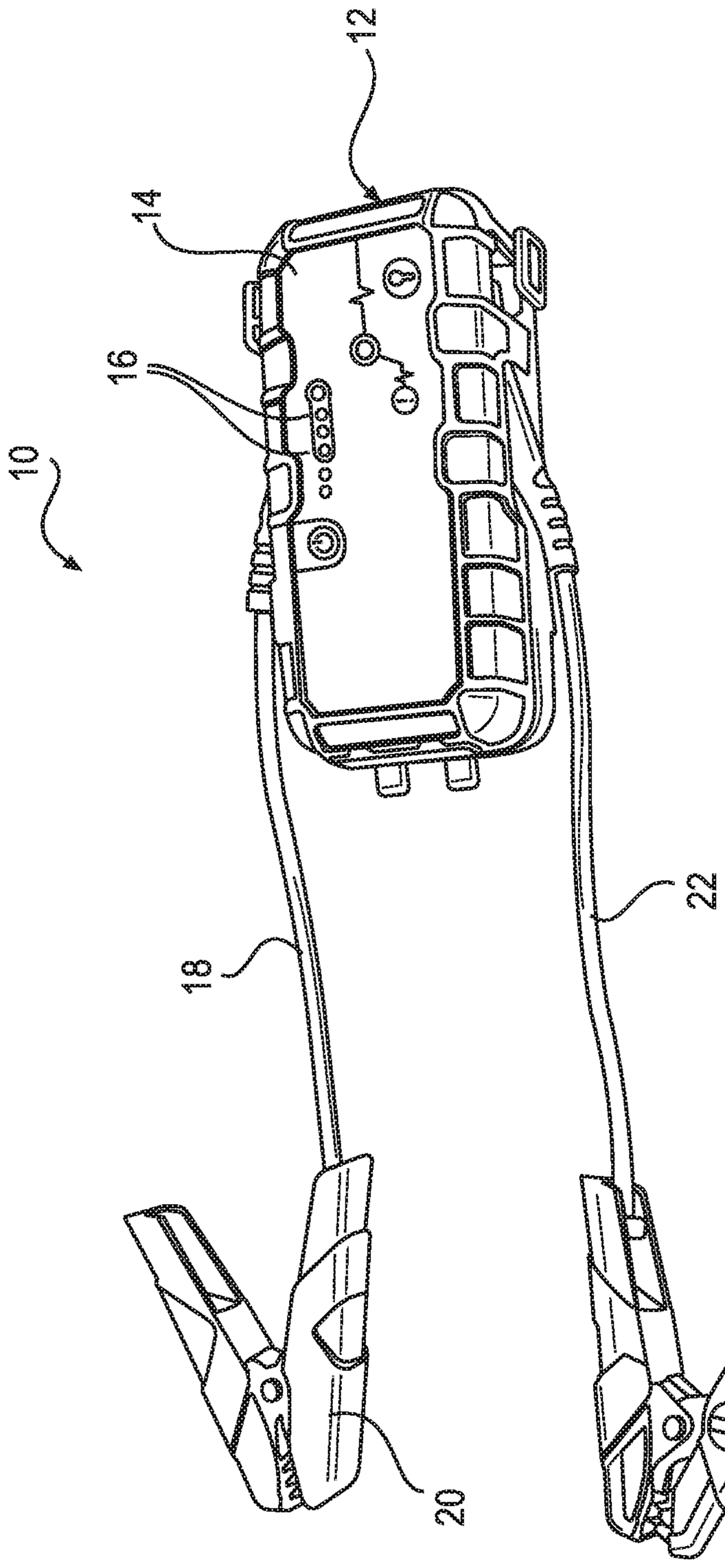


FIG. 4

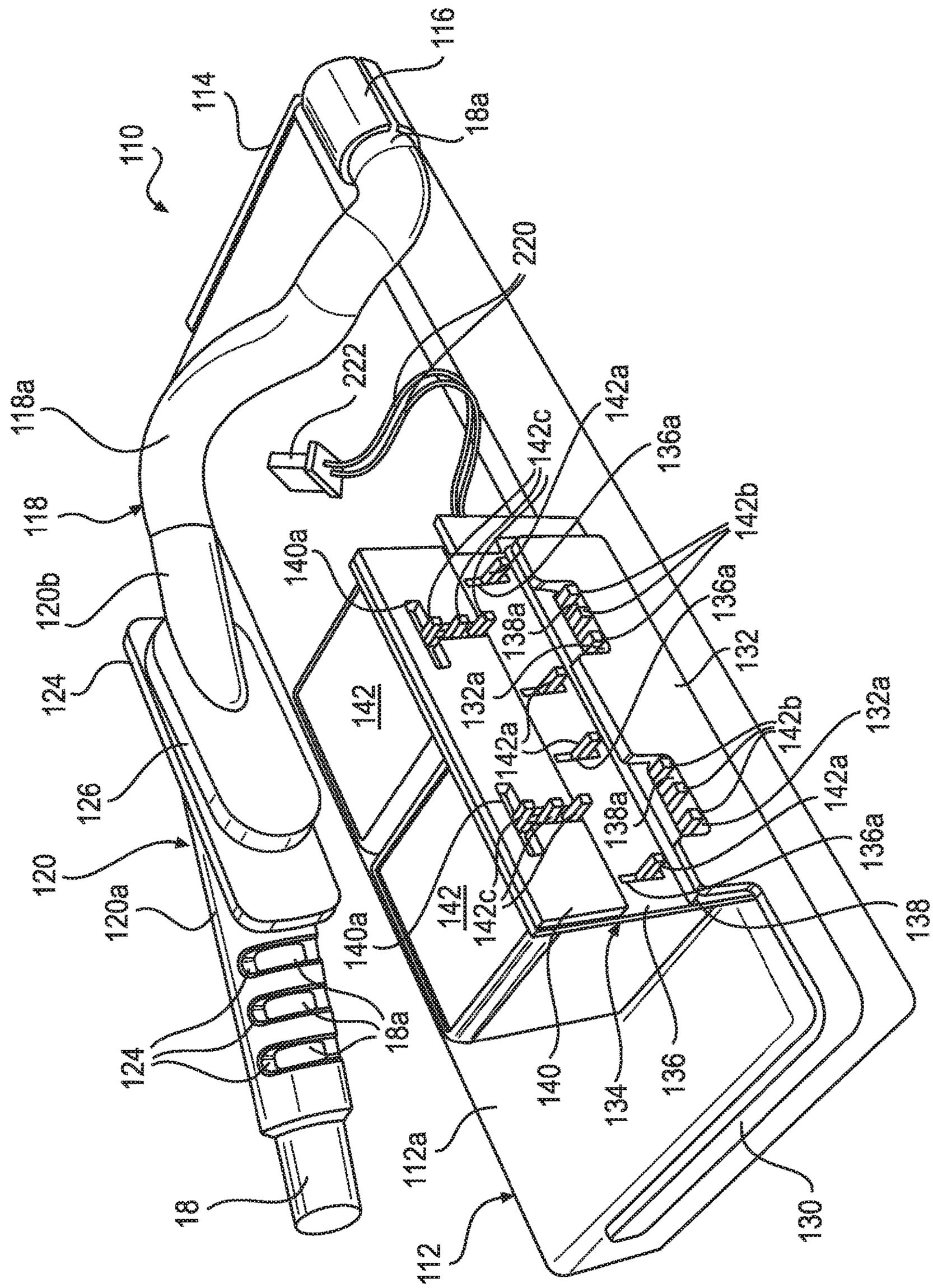
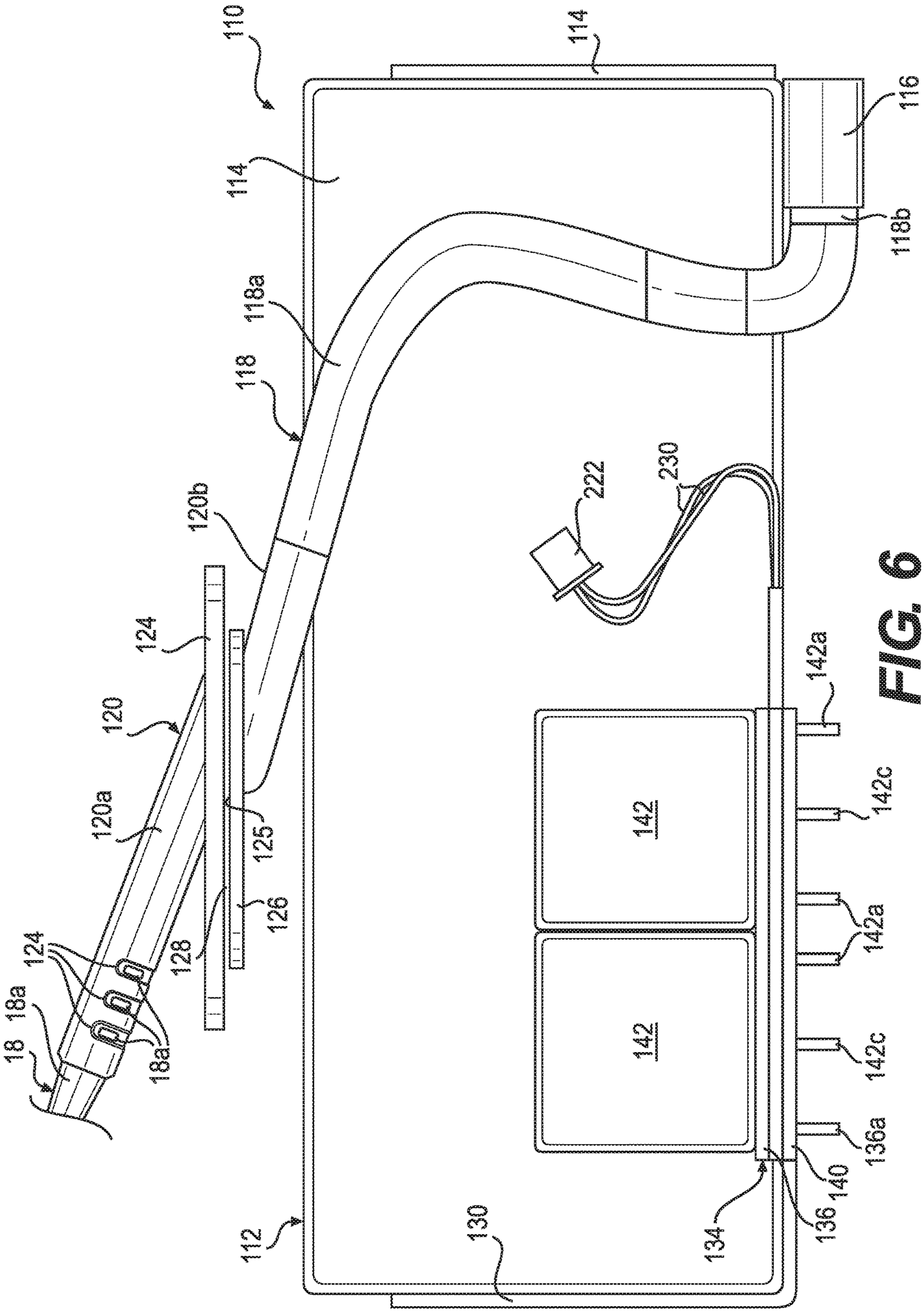

110
114
116
18a
220
222
118a
118
120b
124
126
120
120a
140a
142
142c
142a
136a
132a
138a
132
142b
138
140
134
136
112a
112
130
18

FIG. 5


110
114
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116
118b
118a
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120b
124
120
120a
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126
128
18a
18
124
18a
222
230
142a
142
142
142c
142a
142c
136a
140
136
134
130
112

FIG. 6

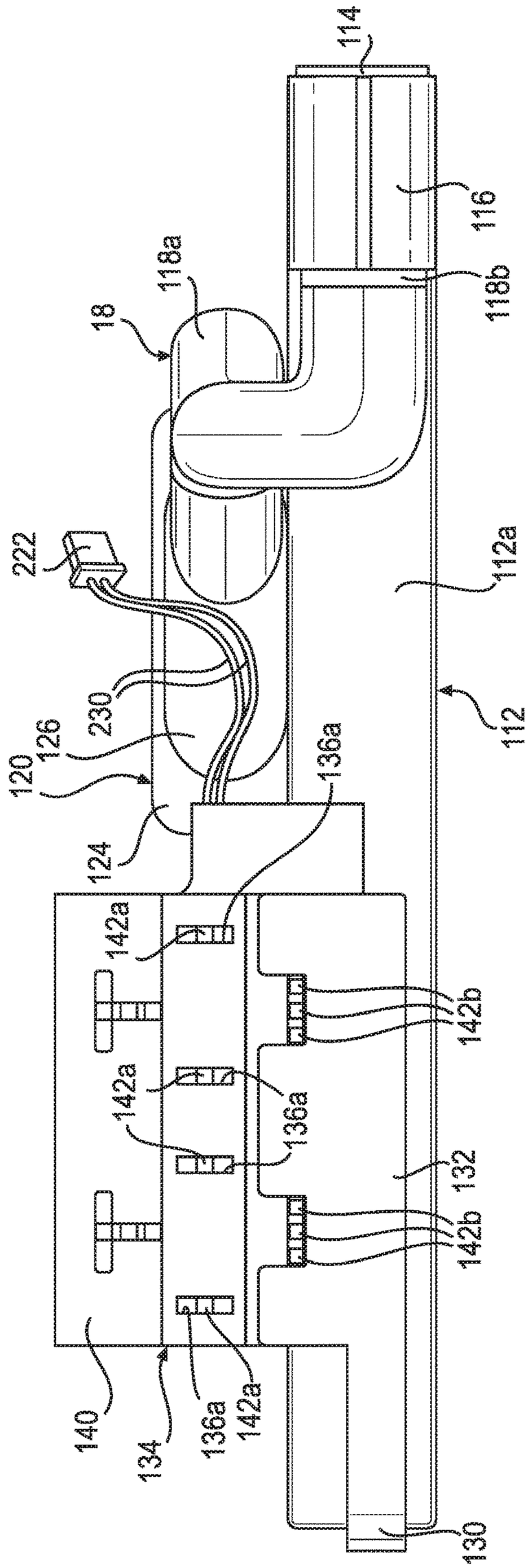
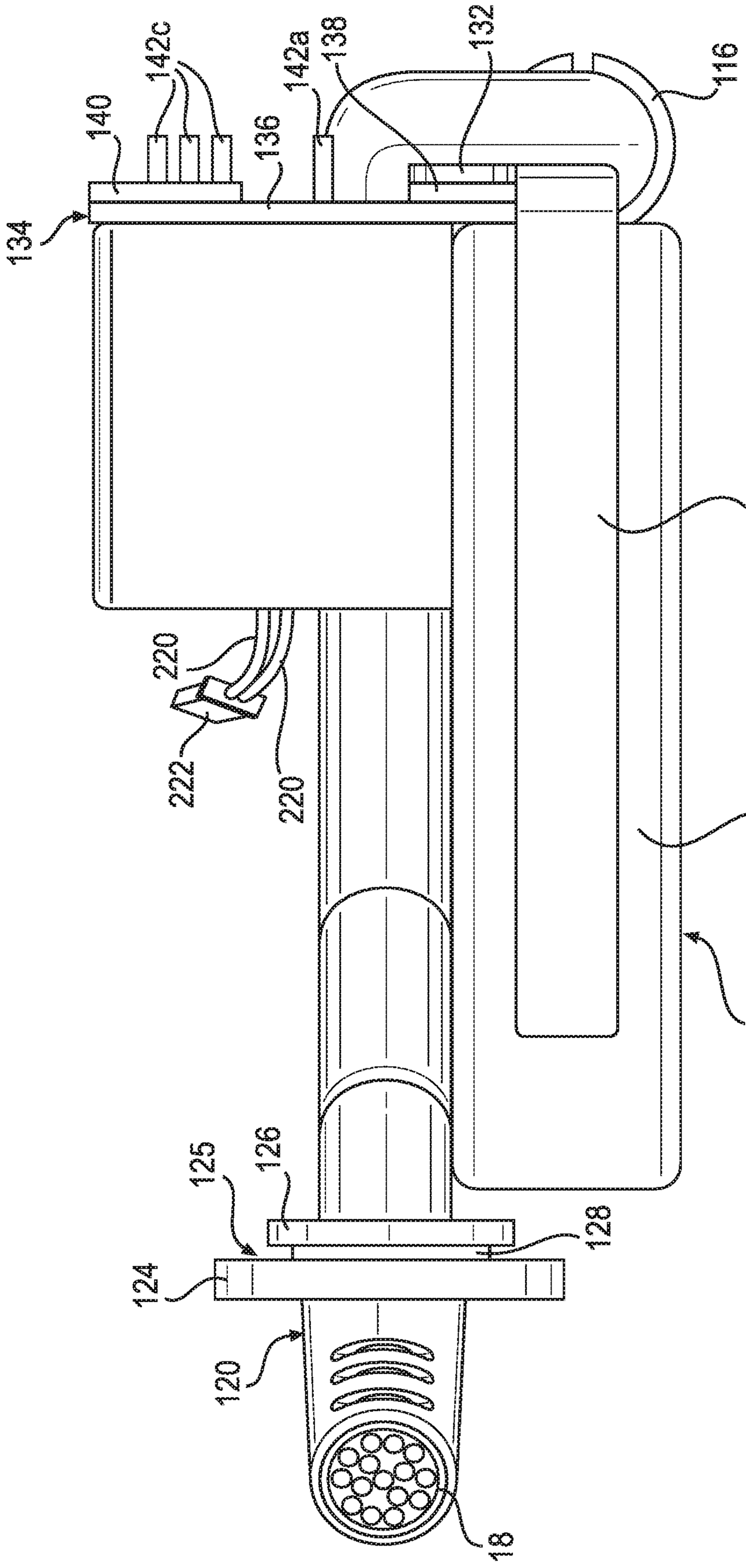

114
116
118a
118b
18
222
112a
230
126
120
112
136a
124
142a
142b
132
140
134
130

FIG. 7


134
140
142c
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142a
138
132
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112a
112
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222
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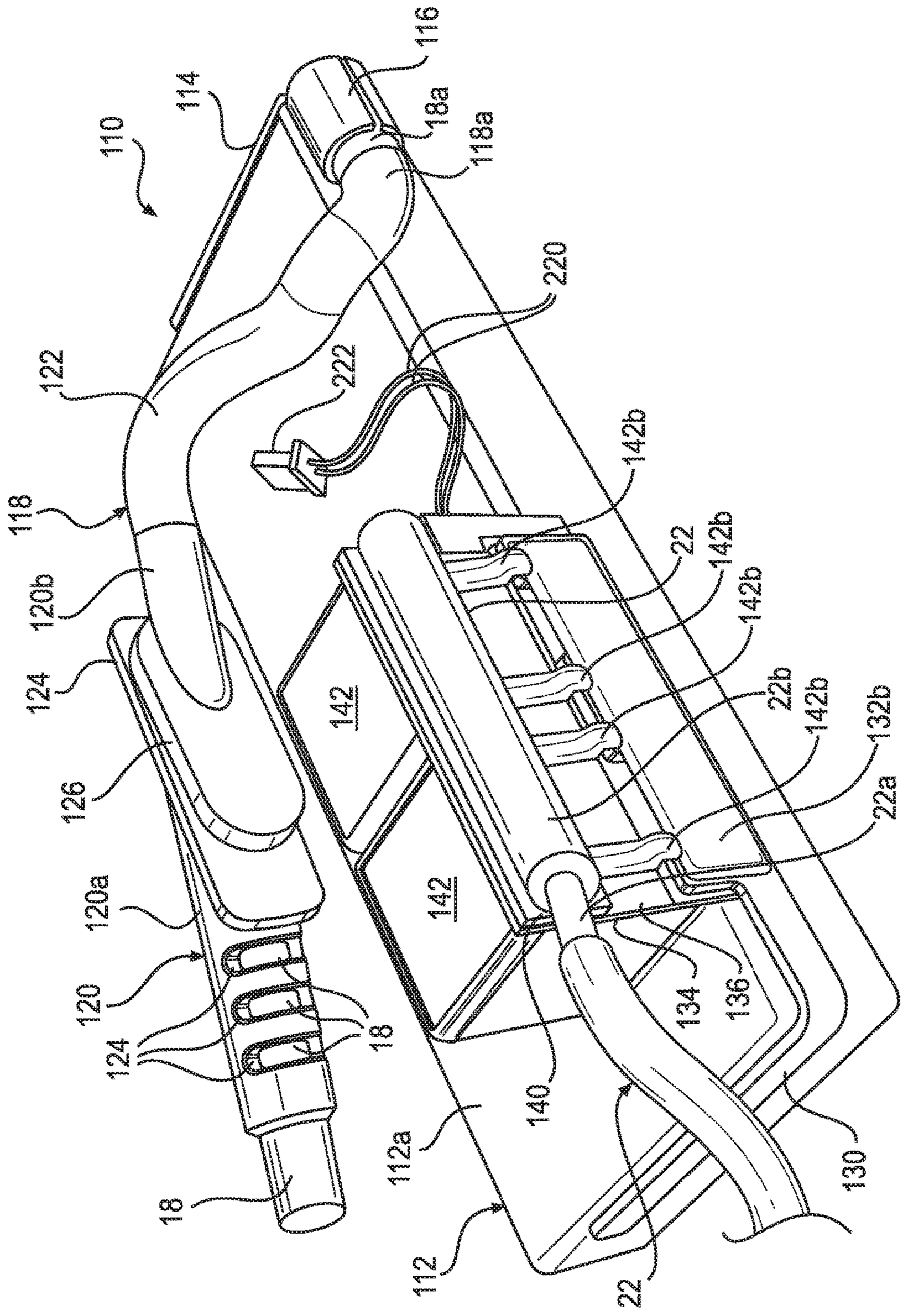
128
124
120
18

FIG. 8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120b
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142
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120a
120
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142b
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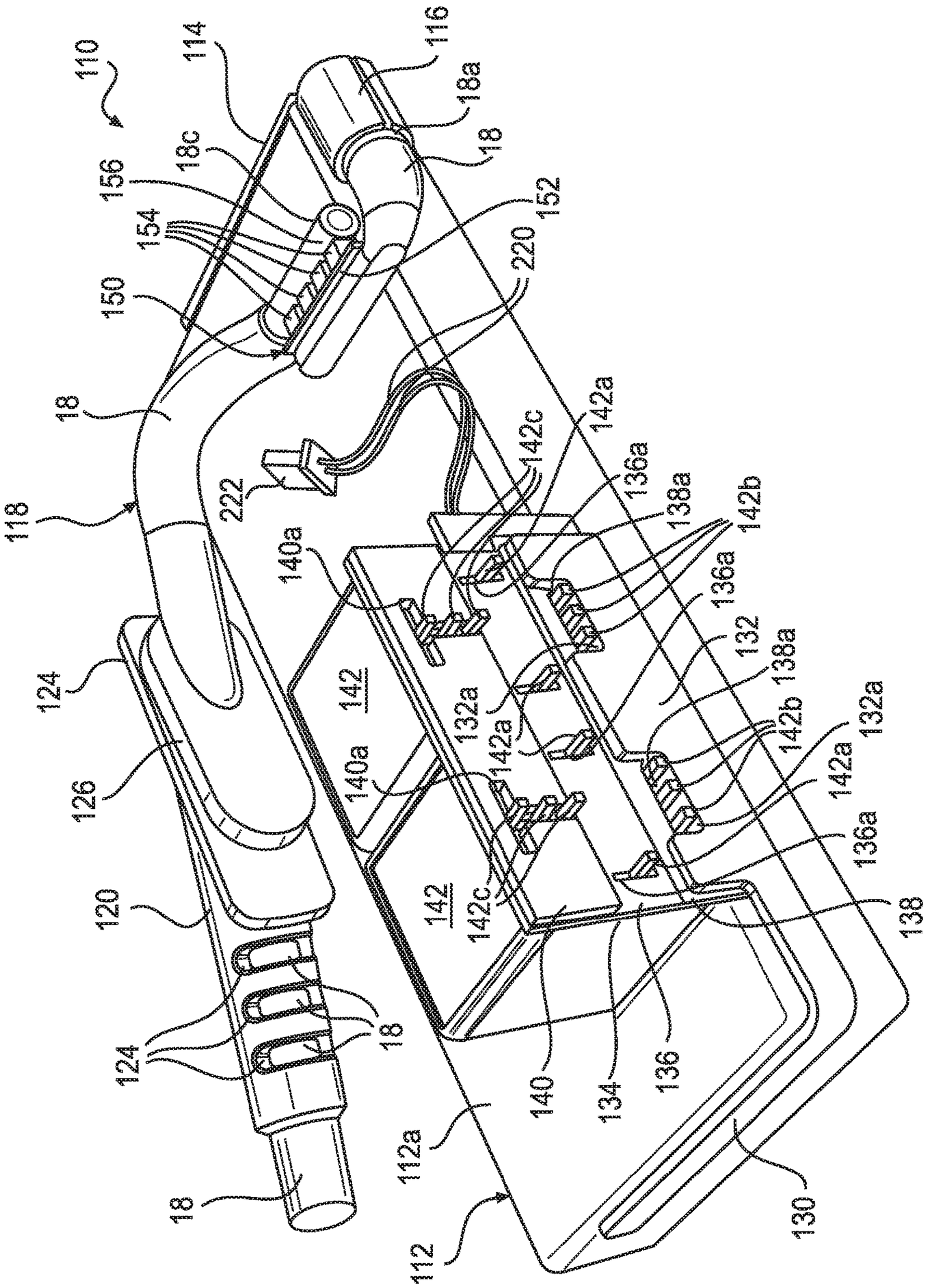
142b
142b
22
22b
132b
22a
134
136
140
112a
112
22
130

FIG. 9


110
114
116
18a
18
18c
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154
152
150
220
18
222
142a
142c
118
136a
138a
142b
140a
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132a
126
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138
142c
18
124
140
134
136
112a
112
130

FIG. 10

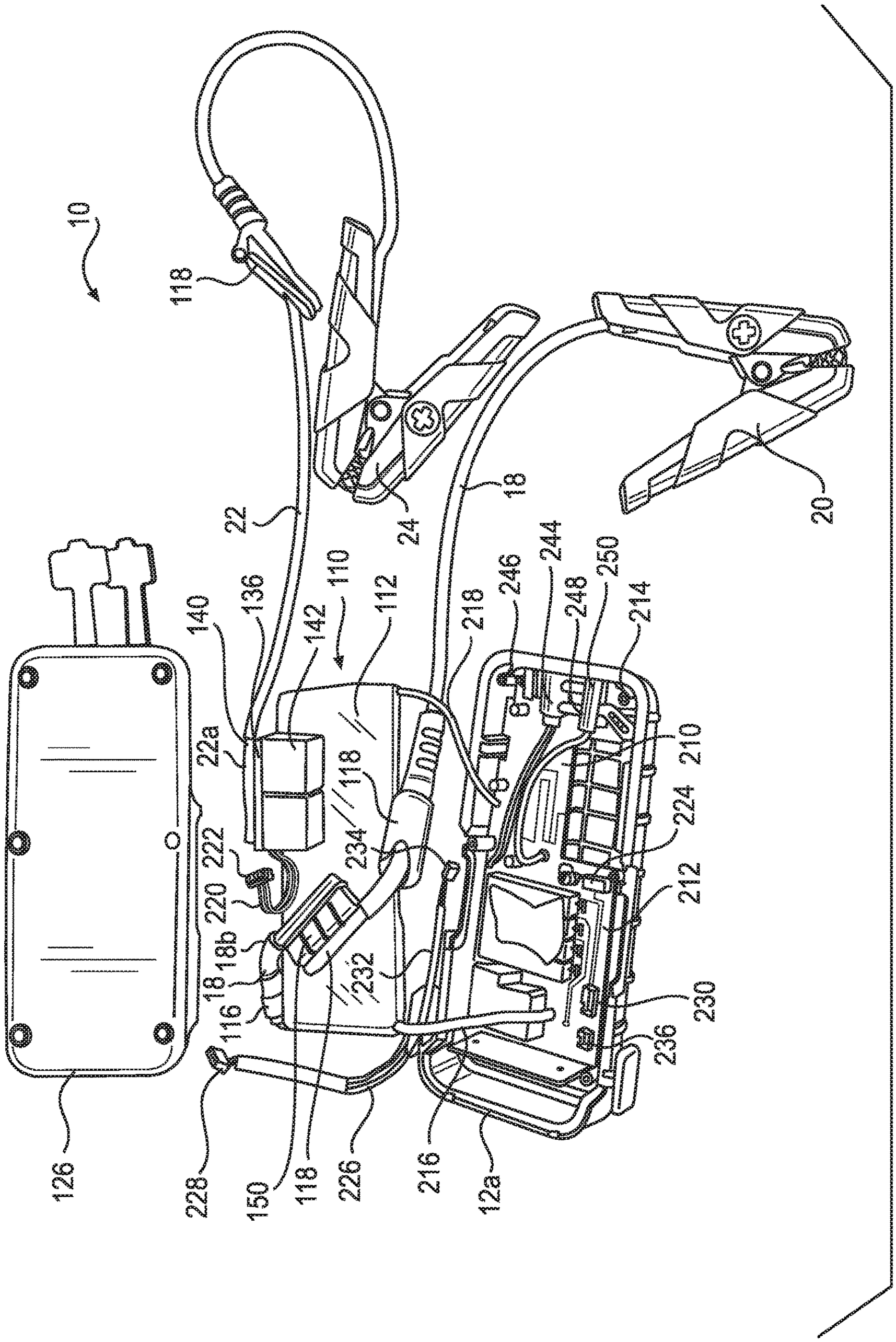
10
118
22
24
18
20
140
136
142
110
112
218
246
244
248
250
214
210
224
212
22a
118
234
222
220
18b
18
116
232
230
236
126
228
150
118
226
216
12a

FIG. 11

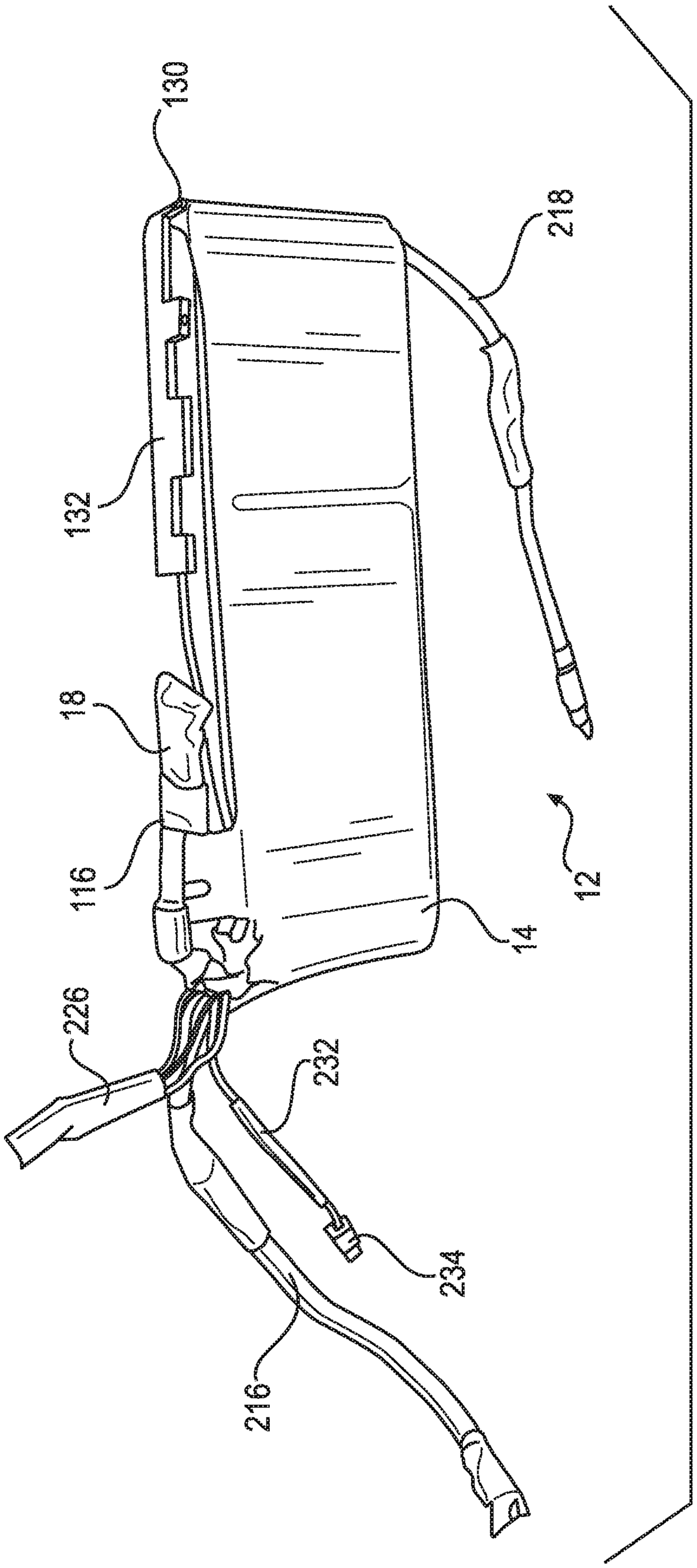

FIG. 12

BATTERY ASSEMBLY DEVICE

FIELD

A battery assembly device, for example, for use in a battery jump starting device.

BACKGROUND

The exists a portable vehicle battery jump start apparatus as disclosed in U.S. Pat. No. 9,007,015 to Nook et al. The apparatus utilizes a lithium ion battery pack. In this type of apparatus, there exists a need to maximize conductivity from the battery pack of the apparatus to the vehicle battery of the vehicle being jump started.

For successful car jump-starts, there are two main factors dictating the results. The first factor is the amount of power provided by the lithium ion battery pack, and the second factor is the maximum conductivity. You need both factors to have the best chance to jump-start big engines. One factor without the other factor is not enough.

SUMMARY

The subject matter relates to a battery assembly device for use with an apparatus for jump starting a vehicle, and an apparatus for jump starting a vehicle comprising the battery assembly device.

The subject matter relates to the following objects.

A battery assembly device comprising or consisting of a battery having at least one battery conductor connected to a terminal of the battery.

A battery assembly device comprising or consisting of a battery having at least one battery conduct connected to a terminal tab of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, the battery conductors being soldered to the respective terminal contacts of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to one of the battery conductors of the battery.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a relay connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and multiple relays connected to the negative battery conductor.

A battery assembly device comprising or consisting of a battery having a positive battery conductor connected to a positive terminal contact of the battery and a negative battery conductor connected to a negative terminal contact of the battery, and a positive cable connected to the positive battery conductor.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front perspective view of the battery jump starting device with the clamps undeployed.

FIG. **2** is a rear perspective view of the battery jump starting device shown in FIG. **1**.

FIG. **3** is an end perspective view of the battery jump starting device shown in FIGS. **1** and **2**.

FIG. **4** is a front perspective view of the battery jump starting device shown in FIG. **1**, however, with the clamps deployed.

FIG. **5** is a perspective view of a battery assembly device contained within the battery jump starting device shown in FIG. **1** when installed therein, however, with the negative cable not yet installed.

FIG. **6** is a top planer view of the battery assembly device shown in FIG. **5**.

FIG. **7** is a front elevational view of the battery assembly device shown in FIG. **5**.

FIG. **8** is a side view of the bent cable connector for the positive cable.

FIG. **9** is a perspective view of the battery assembly device shown in FIG. **5**, with the negative cable connected to the battery assembly device.

FIG. **10** is a perspective view of the battery assembly device shown in FIG. **5** with a diode device installed on the positive cable.

FIG. **11** is a perspective view of the battery assembly device connected to other components or devices of the battery jump starting device.

FIG. **12** is a perspective view of the battery pack device contained within the battery jump starting device shown in FIG. **1** when installed therein.

DETAILED DESCRIPTION

A battery jump starter device **10** is shown in FIGS. **1** and **2**. The battery jump starting device **10** comprises a casing **12** having a display **14** provided with an arrangement of light emitting diodes **16** (LEDs). The battery jump starting device **10** further comprises a positive cable **18** having a positive clamp **20** and a negative cable **22** having a negative clamp **24**. The positive cable **18** and negative cable **22** pass through openings **12***a*, **12***b* in the casing **12**, and are wired to an internally located component (i.e. battery assembly device) to be described in detail below.

The clamps **20**, **24** are stowed away or docked in an undeployed mode by clamping each to a respective side posts **26** extending outwardly on opposite sides of the casing **12**, as shown in FIG. **1**. The side posts **26** are shown in FIG. **2**. The clamps **20**, **24** are docked when the battery jump starter device **10** is in non-use, and unclamped from the side post **26** during use.

The battery jump starting device **10** is configured for jump starting a vehicle battery. For example, the battery jump starting device **10** can be the PORTABLE VEHICLE JUMP START APPARATUS WITH SAFETY PROTECTION dis-

closed in U.S. Pat. No. 9,007,015, which is fully incorporated herein by reference, or an apparatus similar thereto.

The battery jump starting device **10** comprises a variety of electrical components or parts located inside the casing **12**. For example, the battery jump starting device **10** comprises the battery assembly **110** shown in FIGS. **5-10** and internal electrical components shown in FIG. **11**.

As shown in FIGS. **5-10**, the battery assembly **110** comprises a battery **112**. For example, the battery **112** is a lithium ion rechargeable type battery. The battery assembly **110** is configured to maximize electrical conductivity from the battery **112** to the cables **18**, **22** and clamps **20**, **24** of the battery jump starter device **10**. The battery **112** comprises a casing, for example, a rectangular-shaped casing **112***a*.

The battery assembly **110** further comprises a positive terminal conductor bar **114** connected (e.g., soldered) at one end to the positive terminal tab (i.e. contact) of the rechargeable battery **112**. The other end of the positive terminal conductor bar **114** is provided with a conductive loop **116** wrapping around and connected (e.g. crimped and/or soldered) to an exposed conductor end **18***a* of a cable conductor for the positive cable **18**. The battery assembly **110** also comprises a negative terminal conductor bar **130** connected (e.g. soldered) to the negative terminal tab (i.e. contact) of the rechargeable battery **112**. In addition, the width dimension of the terminal conductor bars **114**, **130** is aligned with a thickness dimension of the rechargeable battery **112**, and the length dimension of the terminal conductor bars **114**, **130** is aligned with at least one of the length dimension and width dimension of the rechargeable battery **112**, as shown in FIGS. **5-7**. The terminal conductor bars **114**, **130** have rectangular-shaped cross-sections, as shown in FIGS. **5-7**. In addition, as shown in FIGS. **5** and **6**, the positive terminal conductor bar **114** comprises a first portion that extends along a width of the lithium ion rechargeable battery pack **112** and a second portion that extends a first distance along a length of the lithium ion rechargeable battery pack **112**, and the negative terminal conductor bar **130** comprises a first portion that extends along a width of the lithium ion rechargeable battery pack **112** and a second portion that extends a second distance along the length of the lithium ion rechargeable battery pack **112**, wherein the second distance is greater than the first distance.

As shown in FIGS. **5** and **6**, the positive terminal conductor bar **114**, for example, can be L-shaped so as to wrap around a square-shaped corner of the rectangular-shaped casing **112***a* of the battery **112** (e.g. when viewing the battery **112** in plan view). The L-shaped positive terminal conductor bar **114** extends along an end of the battery **112** and along at least a portion of the side of the battery **112**, as shown in FIG. **6**.

The positive terminal conductor bar **114** can also be mechanically coupled and/or adhered to the outer surface of the battery casing **112***a* to provide additional structural support and stability thereof (e.g. to survive mechanical shock in the event of accidentally dropping battery jump starter device **10**). For example, the positive terminal conductor bar **114** can be mechanically connected to the battery casing **112***a* by adhesive (e.g. silicone adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The positive cable **18** comprises a bent cable portion **118** connecting the positive cable **18** to the positive terminal conductor bar **114**. The bent cable portion **118** comprises an outer sleeve portion **118***a* transitioning into flexible sleeve **120**. The flexible sleeve **120** comprises an outer sleeve portion **120***a* located externally relative to the casing **112** of the battery jump starter device **10**, and a flexible inner sleeve portion **120***b* located internally relative to the casing **112** of the battery jump starter device **10**.

The flexible sleeve **120** is configured to reinforce the connection between the positive cable **18** and the casing **12** of the battery jump starter device **10** while remaining flexible. For example, the flexible sleeve **120** is provided with one or more grooves **124** (three (3) shown in FIG. **3**) exposing the outer sleeve **18***a* of the positive cable **18**. The one or more grooves **124** act as hinges to ease bending of the positive cable **18** at the location of the flexible outer sleeve portion **120**.

The flexible sleeve **120** further comprises an outer flange **124** spaced apart from an inner flange **126** defining a groove **125** therebetween. For example, the outer flange **124** is spaced apart a distance equal to the wall thickness of the casing **12** from the inner flange **126**. The flanges **124**, **126** are configured to anchor the flexible connector **120** along with the positive cable **18** to the casing **12** of the battery jump starter device **10**. A sleeve portion **128** (FIG. **6**) of the flexible connector **120** connects together the outer flange **126** and inner flange **128**. For example, the flexible sleeve **120** is molded separately and assembled onto the positive cable **18**, or molded onto the positive cable **18** to form a single unit. For example, the flexible outer sleeve portion **120** is insert injection molded with a portion of the positive cable **18** inserted within the mold during the molding process. Alternatively, the flexible outer sleeve portion **120** is made (e.g. molded) separately, and then installed or assembled onto a portion of the positive cable **18**. For example, the positive cable **18** comprises an inner conductor (e.g. solid wire conductor or multi-strand metal wire conductor, e.g. made of copper, aluminum) and an outer insulating sleeve **18***a* (e.g. molded plastic sleeve). The flexible sleeve **120** can be applied (e.g. molded or installed or assembled) onto and surrounding the outer sleeve **18***a* of the positive cable **18**.

The battery assembly **110** further comprises a negative terminal conductor bar **130** connected (e.g. soldered) at one end to the negative terminal tab (i.e. contact) of the battery **112**. The other end of the negative terminal conductor bar **130** is provided with a negative terminal conductor bar connector portion **132**, as shown in FIG. **5**.

The negative terminal conductor bar **130** can be L-shaped to wrap around a corner of the rectangular-shaped battery **112**, as shown in FIG. **6**. The L-shaped negative terminal conductor bar **130** extends along an end of the battery **112** and along at least a portion of the side of the battery **112**.

The negative terminal conductor bar **130** can also be mechanically coupled and/or adhered to the outer surface of the battery casing **112***a* to provide additional support and stability thereof (e.g. to survive mechanical shock in the event of accidental dropping battery jump starter device **10**). For example, the negative terminal conductor bar **114** can be mechanically connected to the battery casing **112***a* by adhesive (e.g. silicon adhesive), double sided tape, double sided foam tape, insulating plastic or ceramic connector with snap fit connection and/or mechanical fastener.

The battery assembly **110** further comprises a smart switch battery interface **134**, as shown in FIG. **5**. The smart switch battery interface **134** comprises a circuit board **136** having a first circuit board conductor bar **138** spaced apart from a second circuit board conductor bar **140** both located on one side of the circuit board **136**, as shown in FIG. **5**.

A pair of relays **142** are mounted on an opposite side of the circuit board **136**. The relays **142** include relay anchoring

pins **142***a* extending through the slots **136***a* in the circuit board **136** (FIG. **5**). The relays **142** further include first relay connector pins **142***b* extending through the slots located in both in the circuit board **136** and through slots **132***a* in the negative terminal conductor bar connector portion **132**. The relays **142** even further include second relay connector pins **142***c* extending through the slots located in both the circuit board **136**, windows **138***a* of the first circuit board conductor bar **138**, and the slots **132***a* provided in the first conductor bar **138**. The relay anchoring pins **136***a* are soldered in place to mechanically connect the relays **142** to the circuit board **136**. The relay connecting pins **142***b* and **142***c* are soldered in place to mechanically and electrically connect the relays **142**, respectively, to the circuit board conductor plates **138**, **140**.

The slots **136***a* in the circuit board **136**, for example, are rectangular-shaped (FIG. **5**), and accommodate the rectangular-shaped relay anchoring pins **142***a*. Specifically, a base portion of the relay anchoring pins **142***a* are rectangular-shaped transitioning to square-shaped ends. The square-shaped ends are dimensionally less wide verses the base portions creating transverse edges oriented flush with the outer surface of the circuit board **136**. When solder is applied to the exposed ends of the relay anchoring pins **142***a*, the solder connects to the sides of the square-shaped ends and transverse edges to anchor and lock the relay anchoring pins **142***a* to the circuit board **136**.

The slots **132***a* are provided in negative terminal conductor bar connector portion **132**, and the slots **138***a* in the first circuit board conductor bar **138** are rectangular-shaped. The slots **140***a* in the second circuit board conductor bar **140** (FIG. **5**) are T-shaped to accommodate the three (3) horizontally oriented relay connector pins **142***b*. The ends of the relay connector pins **142***b* are shown flush with the outer surface of the negative terminal conductor bar connector portion **132**. When solder is applied to the exposed ends of the relay connector pins **142***b*, the solder fills in the slots **132***a* in the negative terminal conductor bar connector portion **132** and the slots **138***a* of the first circuit board conductor bar **138**, and connects the sides of the connector pins **142***b* with inner edges of the slots **132***a* and slots **138***a* to anchoring the relays **142** to the circuit board **136** and negative terminal conductor bar connector portion **132**. This applied solder also electrically connects the negative terminal conductor bar connector portion **132** to the first circuit board conductor bar **138**.

The slots **140***a* provided in the second circuit board conductor bar **140** are T-shaped to accommodate the three (3) vertically oriented second relay connecting pins **142***c*. The second relay connector prongs **142***c* extend outwardly from the outer surface of the circuit board **136** to connect with the exposed cable end **14***a* of the negative cable **14**, as shown in FIG. **9**. When solder is applied to the ends of the second relay connector prongs **142***c*, the solder fills in the T-shaped slots **140***a* (FIG. **5**) and electrically connects the second relay connector prongs **140***c* to the second circuit board conductor bar **140**. The exposed cable end **22***a* of the negative cable **22** is soldered to the second relay connector prongs **142***c* (FIG. **5**), as shown in FIG. **9**.

The negative terminal conductor bar connector portion **132** of the negative terminal conductor bar **130** is connected (e.g. by soldering) to the first circuit board conductor bar **138** of the circuit board **136**. Again, the exposed cable end **22***a* (i.e. with the insulating sleeve removed) of the negative cable **22** is connected (e.g. by soldering) to the second circuit board conductor bar **140**, as shown in FIG. **9**. The negative cable **22** is fitted with a flexible sleeve **118**, as shown in FIG. **11**.

As an alternative to the arrangement of the bent cable connector **118** (FIG. **5**), a diode device **150** is installed onto (i.e. spliced into) the flexible cable connector **118**, as shown in FIG. **10**. The diode device **150** comprises a circuit board **152** provided with a set of back-charge diodes **154** located on one side thereof, and a conductor bar **156** provided on an opposite side of the circuit board **152**.

Assembly

The battery jump starting device **10** comprises the casing **12** having an upper casing portion **12***a* and a lower casing portion **12***b*, as shown in FIG. **11**. The upper casing portion **12***a* and the lower casing portion **12***b* are configured to be connected together when assembling the battery jump starting device **10**.

The battery jump starting device **10** further comprises the battery assembly **110** and controller assembly **210** both disposed within the casing **12** when assembling the battery jump starting device **10**, as shown in FIG. **11**. The controller assembly **210** comprises a circuit board **212** located adjacent to another circuit board **214**.

The positive terminal of the battery assembly **110** is connected to the circuit board **212** via a positive power wire **216**, as shown in FIG. **11**. For example, the positive power wire **216** is soldered to the positive conductor bar **114** (FIG. **5**). The negative terminal of the battery assembly **110** is connected to the circuit board **214** via a negative power wire **218**.

The relay circuit board **136** is provided with a wire set **220** having a connector **222**, as shown in FIG. **11**. The connector **222** is configured to connect with the relay board connector **224** located on the circuit board **212** of the controller assembly **210** during assembly of the battery jump starting device **10**, as shown in FIG. **11**.

The battery assembly **110** further comprises a wire set **226** having a connector **228**, as shown in FIG. **11**. The connector **228** is configured to connect with the battery cell charging/monitoring connector **230** located on the circuit board **212** of the controller assembly **220**.

The battery assembly **110** also comprises a battery temperature sensor having a wire set **232** having a connector **234**, as shown in FIG. **11**. The connector **234** is configured to connect with the temperature sensor connector **236** located on the circuit board **212** of the controller assembly **220**.

The circuit board **212** is provided with in charge power resistors **240** and an out relay **242**, as shown in FIG. **11**. Further, the lower casing portion **12***a* is provided with a main user out connector **244** having a wire set **246** connected to the circuit board **214**, and a main user in connector **248** having a wire set **250** connected to the circuit board **214**.

The battery assembly **110** is connected to battery jump starting device **10**, as shown in FIG. **11**. The battery connector device **110** is installed within the casing **12** of the battery jump starting device **10** when assembled.

The invention claimed is:

1. A rechargeable battery assembly device for use in a battery jump starting device, the battery jump starting device having a positive battery cable and a negative battery cable, the rechargeable battery assembly device comprising:

a lithium ion rechargeable battery pack comprising a positive terminal tab located on one end of the lithium

ion rechargeable battery pack and a negative terminal tab located on an opposite end of the lithium ion rechargeable battery pack;

a positive terminal conductor bar comprising a first portion that extends along a width of the lithium ion rechargeable battery pack, the positive terminal conductor bar soldered or welded to the positive terminal tab of the lithium ion rechargeable battery pack, the first portion of the positive terminal conductor bar having an outer end extending beyond the width of the lithium ion battery pack and electrically connected or connectable to the positive battery cable, the positive terminal conductor bar further comprising a second portion that extends a first distance along a length of the lithium ion rechargeable battery pack; and

a negative terminal conductor bar comprising a first portion that extends along a width of the lithium ion rechargeable battery pack, the negative terminal conductor bar soldered or welded to the negative terminal tab of the lithium ion rechargeable battery pack, the first portion of the negative terminal conductor bar having an outer end extending beyond the width of the lithium ion battery pack and electrically connected or connectable to the negative battery cable, the negative terminal conductor bar further comprising a second portion that extends a second distance along the length of the lithium ion rechargeable battery pack, wherein the second distance is greater than the first distance.

2. The rechargeable battery assembly device according to claim **1**, wherein both the positive terminal conductor bar and negative terminal conductor bar have rectangular-shaped cross-sections.

3. The rechargeable battery assembly device according to claim **1**, wherein the positive terminal conductor bar and the negative terminal conductor bar are oriented parallel relative to each other.

4. The rechargeable battery assembly device according to claim **1**, wherein an outer end of the positive terminal conductor bar wraps around an exposed conductor of an end of the positive cable.

5. The rechargeable battery assembly device according to claim **1**, wherein the lithium ion rechargeable battery pack is rectangular-shaped, and the positive terminal conductor bar and the negative terminal conductor bar are L-shaped and are bent around respective corners of the lithium ion rechargeable battery pack.

6. The rechargeable battery assembly device according to claim **1**, wherein the positive battery cable is connected to the positive terminal conductor bar by a cable portion.

7. The rechargeable battery assembly device according to claim **6**, wherein the cable portion comprises a flexible outer sleeve portion and a flexible inner sleeve portion.

8. The rechargeable battery assembly device according to claim **7**, wherein the flexible outer sleeve portion comprises an outer flange, and the flexible inner sleeve portion comprises an inner flange, the outer flange and inner flange sandwiching a casing wall of the battery jump starting device.

9. The rechargeable battery assembly device according to claim **6**, wherein the cable portion comprises an inner serpentine cable portion.

10. The rechargeable battery assembly device according to claim **9**, wherein the cable portion is configured to accommodate the positive battery cable oriented at an angle relative to the casing wall of the battery jump starting device, and the inner serpentine cable portion is configured to accommodate a misalignment between the angle relative to the casing wall and an angle of attachment of the inner serpentine cable portion with the positive terminal conductor bar.

11. The rechargeable battery assembly device according to claim **1**, wherein the rechargeable lithium ion rechargeable battery pack comprises a casing.

12. The rechargeable battery assembly device according to claim **1**, wherein the positive terminal conductor bar and negative terminal conductor bar are connected in electrical series with the rechargeable lithium ion rechargeable battery pack.

13. The battery jump starting device according to claim **1**, further comprising a smart switch connected to and controlling a smart switch interface.

14. The battery jump starting device according to claim **13**, wherein the smart switch interface comprises a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar.

15. The battery jump starting device according to claim **14**, wherein the negative terminal conductor bar is connected to the first circuit board conductor bar.

16. A rechargeable battery assembly device for use in a battery jump starting device, the battery jump starting device having a positive battery cable and a negative battery cable, the rechargeable battery assembly device comprising:

a rectangular-shaped lithium ion rechargeable battery pack comprising a positive terminal tab located on one end of the rectangular-shaped lithium ion rechargeable battery pack and a negative terminal tab located on an opposite end of the rectangular-shaped lithium ion rechargeable battery pack;

a positive terminal conductor bar comprising a first portion that extends along a width of the lithium ion rechargeable battery pack, the positive terminal conductor bar soldered or welded to the positive terminal tab of the rectangular-shaped lithium ion rechargeable battery pack, the first portion of the positive terminal conductor bar having an outer end located at a side of the lithium ion battery pack and extending beyond the width of the lithium ion battery pack and electrically connected or connectable to the positive battery cable, the positive terminal conductor bar further comprising a second portion that extends a first distance along a length of the rectangular-shaped lithium ion rechargeable battery pack; and

a negative terminal conductor bar located on the opposite end and comprising a first portion that extends along the width of the lithium ion rechargeable battery pack, the negative terminal conductor bar having one end soldered or welded to the negative terminal tab of the rectangular-shaped lithium ion rechargeable battery pack, the first portion of the negative terminal conductor bar having an outer end located at the side of the lithium ion battery pack and extending beyond the width of the lithium ion battery pack and electrically connected or connectable to the negative battery cable, the negative terminal conductor bar further comprising a second portion that extends a second distance along the length of the rectangular-shaped lithium ion rechargeable battery pack, wherein the second distance is greater than the first distance.

17. The battery jump starting device according to claim **16**, further comprising a smart switch connected to and controlling a smart switch interface.

18. The battery jump starting device according to claim **17**, wherein the smart switch interface comprises a circuit

board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar.

19. The battery jump starting device according to claim **18**, wherein the negative terminal conductor bar is connected to the first circuit board conductor bar.

20. A rechargeable battery assembly device for use in a battery jump starting device, the battery jump starting device having a positive battery cable and a negative battery cable, the rechargeable battery assembly device comprising:

a rectangular-shaped lithium ion rechargeable battery pack comprising a positive terminal tab located on one end of the rectangular-shaped lithium ion rechargeable battery pack and a negative terminal tab located on an opposite end of the rectangular-shaped lithium ion rechargeable battery pack;

an L-shaped positive terminal conductor bar located on the one end and comprising a first portion that extends along a width of the rectangular-shaped lithium ion rechargeable battery pack, the L-shaped positive terminal conductor bar connected to the positive terminal of the rectangular-shaped lithium ion rechargeable battery pack, the first portion of the L-shaped positive terminal conductor bar having an outer end extending beyond the width of the lithium ion battery pack and along a side of the lithium ion battery pack, the outer end of the L-shaped positive terminal conductor bar electrically connected or connectable to the positive battery cable, the L-shaped positive terminal conductor bar further comprising a second portion that is bent around a corner of the rectangular-shaped lithium ion rechargeable battery pack and a third portion that extends a first distance along a length of the rectangular-shaped lithium ion rechargeable battery pack; and

an L-shaped negative terminal conductor bar comprising a first portion that extends along the width of the rectangular-shaped lithium ion rechargeable battery pack, the first portion of the L-shaped negative terminal conductor bar having one end connected to the negative terminal tab of the rectangular-shaped lithium ion rechargeable battery pack, the L-shaped negative terminal conductor bar having an outer end extending beyond the width of the rectangular-shaped lithium ion battery pack and along an opposite side of the rectangular-shaped lithium ion battery pack, the outer end of the L-shaped negative terminal conductor bar electrically connected to or connectable to the negative battery cable, the L-shaped negative terminal conductor bar further comprising a second portion that is bent around a corner of the rectangular-shaped rechargeable battery pack and a third portion that extends a second distance along the length of the rectangular-shaped lithium ion rechargeable battery pack, wherein the second distance is greater than the first distance.

21. The battery jump starting device according to claim **20**, further comprising a smart switch connected to and controlling a smart switch interface.

22. The battery jump starting device according to claim **21**, wherein the smart switch interface comprises a circuit board having a first circuit board conductor bar spaced apart from a second circuit board conductor bar.

23. The battery jump starting device according to claim **22**, wherein the negative terminal conductor bar is connected to the first circuit board conductor bar.

24. A battery jump starting device having a positive battery cable and a negative battery cable, the device comprising:

a lithium ion rechargeable battery pack comprising a positive terminal and a negative terminal;

a positive terminal conductor bar, the positive terminal conductor bar having one end connected to the positive terminal of the rechargeable lithium ion rechargeable battery and an opposite end spaced apart from the one end and electrically connected or connectable to the positive battery cable, the positive terminal conductor bar having at least a portion of the length of the positive terminal conductor bar located at an end of the lithium ion rechargeable battery pack, the positive terminal conductor bar extending a first distance along a length of the lithium ion rechargeable battery pack;

a negative terminal conductor bar, the negative terminal conductor bar having one end connected to the negative terminal of the rechargeable lithium ion rechargeable battery pack and an opposite end spaced apart from the one end and electrically connected or connectable to the negative battery cable, the negative terminal conductor bar having at least a portion of the length of the negative terminal conductor bar located at an another end of the lithium ion rechargeable battery, the negative terminal conductor bar extending a second distance along the length of the lithium ion rechargeable battery pack, wherein the second distance is greater than the first distance;

a smart switch controller; and

a smart switch interface connected to and controlled by the smart switch controller, the smart switch interface comprising a circuit board having a first circuit board conductor bar connected to an opposite end of the negative terminal conductor bar of the lithium ion rechargeable battery pack and a second circuit board conductor bar spaced apart from the first circuit board conductor bar on the circuit board and connected to the negative battery cable, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal of the lithium ion rechargeable battery pack and a battery being jump started by the battery jump starting device.

25. The battery jump starting device according to claim **24**, wherein the one or more relays is multiple relays connected in parallel between the first circuit board conductor bar and the second circuit board conductor bar.

26. The battery jump starting device according to claim **24**, wherein both the positive terminal conductor bar and negative terminal conductor bar have rectangular-shaped cross-sections.

27. The battery jump starting device according to claim **24**, wherein the length of the positive terminal conductor bar and the length of the negative terminal conductor bar are oriented parallel relative to each other.

28. The battery jump starting device according to claim **24**, wherein an outer end of the positive terminal conductor bar wraps around an exposed conductor of an end of the positive cable.

29. The battery jump starting device according to claim **24**, wherein the positive terminal conductor bar is soldered and/or welded to the positive terminal of the lithium ion rechargeable battery pack and the negative terminal conductor bar is soldered and/or welded to the negative terminal of the lithium ion rechargeable battery pack.

30. The battery jump starting device according to claim **24**, wherein the lithium ion rechargeable battery pack is rectangular-shaped, and the positive terminal conductor bar

and the negative terminal conductor bar are L-shaped and are bent around respective corners of the lithium ion rechargeable battery pack.

31. The battery jump starting device according to claim **30**, wherein the positive terminal conductor bar and negative terminal conductor bar are mounted to opposite ends of the rechargeable lithium ion rechargeable battery pack.

32. A battery assembly for a jump starting device having a positive battery cable and a negative battery cable, the battery assembly comprising:

a lithium ion rechargeable battery pack comprising a positive terminal and a negative terminal, the positive terminal being electrically connected or connectable to the positive battery cable;

a positive terminal conductor bar connected to the positive terminal of the lithium ion rechargeable battery pack, and connected or connectable to the positive battery cable, wherein the positive terminal conductor bar comprises a portion that extends a first distance along a length of the lithium ion rechargeable battery pack;

a negative terminal conductor bar, the negative terminal conductor bar connected to the negative terminal of the lithium ion rechargeable battery pack, and connected or connectable to the negative battery cable, wherein the negative terminal conductor bar comprises a portion that extends a second distance along the length of the lithium ion rechargeable battery pack, the second distance being greater than the first distance;

a smart switch controller; and

a smart switch interface connected to and controlled by the smart switch controller, the smart switch interface comprising a circuit board having a first circuit board conductor bar connected to an opposite end of the negative terminal conductor bar of the lithium ion rechargeable battery pack and a second circuit board conductor bar spaced apart from the first circuit board conductor bar on the circuit board and connected to the negative battery cable, the smart switch interface further comprising one or more relays connected between the first circuit board conductor bar and the second circuit board conductor bar for providing isolation between the negative terminal of the lithium ion rechargeable battery pack and a battery being jump started by the battery jump starting device.

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